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Phase 1 Environmental Site Assessment Guideline for Upstream Oil and Gas Sites

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1.0 Introduction

Environmental site assessments (ESAs) are routinely used to determine the environmental condition of a property. Specifically, the objectives of an ESA are to:

- determine if there is reason to suspect that contamination has occurred;
- identify the nature of contaminants;
- define the distribution of contamination in the environment, including air, water and soil;
- determine the risk from the exposure to these contaminants; and
- evaluate the possibility of mitigating these risks.

The site assessment process consists of three phases:

Phase 1 ESAs involve:

- the collection of information about past activities and/or events which have resulted or could result in contamination on a property;
- a site visit to identify visible evidence of contamination sources or actual contamination (no actual soil or water testing is carried out); and
- establishing the need for a Phase 2 ESA.

Phase 2 ESAs are a field evaluation, which typically involve the collection of soil and water samples. The field evaluation program must be designed and implemented to collect the site-specific information necessary to establish the presence or absence of adverse affects.

Phase 3 ESAs typically involve exploring remedial options, developing a hazard assessment, exposure modeling and risk assessment, carrying out remediation and verifying the success of remediation.

2.0 Intent of Document

The intent of this document is to provide guidance on conducting Phase 1 ESAs for wellsites and small upstream petroleum facilities and to clarify how these assessments relate to the reclamation process. In the context of this guideline, the Phase 1 ESA will be used as a screening tool to:

- provide evidence to satisfy the regulators, surface landowner(s) and stakeholders that contamination is not likely present on the property; and/or
- to determine if a Phase 2 ESA is required.

3.0 Qualifications of the Investigator

The investigator should be objective in his assessment and:

- possess an appropriate combination of formal education, knowledge, skills and experience to conduct a technically sound and rational ESA;
- be familiar with applicable federal, provincial and municipal legislation and published guidelines used to evaluate the presence of contamination on a property; and
- be familiar with upstream oil and gas operations.

4.0 Phase 1 Environmental Site Assessment – Desktop Review and Site Visit

The goal of a Phase 1 ESA is to gather a sufficient amount of information to estimate the likelihood, types and location of surface and/or subsurface contamination that may be present at the property and adjoining land. The information generated in a Phase 1 ESA can be used by the property owners, facility operators, purchasers, lenders and lessees to make informed decisions about the need for further assessments, property management, facility operations, options for future land use, investment and remedial actions.

4.1 Desktop Review

The desktop review requires gathering and examining the existing information available on the site without actually collecting physical data in the field. A comprehensive desktop review of existing and historical information about activities and events at the site can facilitate appropriate planning and ensure implementation of an efficient, safe and thorough field investigation program. Desktop reviews are conducted to:

- obtain information about current and historical land uses and activities that may indicate the existence or likelihood of surface and subsurface contamination at the site;
- identify potential surface and/or subsurface contamination sources and any environmental concerns at the site (common contamination sources at upstream petroleum facilities are listed in Appendix 1 and a list of contaminants commonly found at upstream petroleum facilities is in Appendix 2); and
- establish the framework for any subsequent site investigation and work plan.

4.1.1 Company File Review

A thorough review of corporate files is a critical step in the Phase 1 ESA process. The following should be reviewed:

- process flow diagrams, blue prints, "as-builts" and similar plans indicating underground storage tanks, vessels, pipelines and other subsurface structures that may be contaminant sources;
- historical records of spills, releases and accidents that may have residual environmental effects;

- corporate files including, but not limited to, previous environmental audits and impact assessments, geotechnical investigations, and environmental monitoring reports; and
- underground utility services that may serve as conduits for contaminant migration.

4.1.2 Air Photo Review

Regardless of whether or not facilities/structures currently exist on the property of concern, a thorough air photo review should be conducted. In the course of reviewing the air photos for the history of the site, changes to lease size, equipment, buildings, pits/sumps as well as any spills on the lease may be documented and flagged for investigation during the field program. Information that may be collected and documented from the air photo review includes:

- year in which the site or individual component is first identified;
- list of equipment, buildings, pits/sumps on lease for each year an air photo is available over the course of the operating life of the facility;
- evidence of spills or vegetation stress on/off lease for each year an air photo is available over the life of the facility;
- proximity of lease to surface water bodies, residences;
- onsite and adjacent land use, vegetation cover;
- topography, surface drainage direction;
- proximity of lease to other contaminant sources and potential receptors; and
- list of photos reviewed (dates, reference numbers, scales) for future reference in the case of an audit.

4.1.3 Review of Published Information

The Alberta Energy and Utilities Board's (EUB) spill database should be consulted for documentation of spills which may have occurred over the life of the facility and which may require further investigation. Although sites for which spills have been documented in the EUB database may be of greater concern, sites without documented spills cannot necessarily be excluded as free of this type of impact.

Groundwater usage in the vicinity of each site may be established by reviewing Alberta Environment's water well records.

In some instances, general information about the physical properties of a site is desired. This information can be obtained from published information such as soil, surficial geology, bedrock topography and bedrock geology maps. Due to the mapping scale utilized in these documents, the information gathered cannot be used as a substitute for site specific investigations, however they do provide a preliminary screening for areas vulnerable to contaminant impacts (e.g., near-surface fractured bedrock, aeolian sands, etc.). In some cases more detailed information about physical characteristics of a site is available in company site assessment reports.

4.2 Site Visit

A site visit should be conducted to verify the results of the file and air photo review. Specifically, the purpose of the site visit is to identify:

- surrounding land use, topography and vegetation;
- nearby surface water bodies, water wells, residences, livestock and other facilities;
- potential sources of spills, leaks or releases;
- visual evidence of on-site and off-site soil contamination (e.g., surface staining, reduced vegetative growth and visible salt crystals);
- waste management practices used at the facility; and,
- any equipment, infrastructure or underground utilities that may be affected during a subsurface investigation.

During the site visit, there should be meetings with lease or adjacent landowners/occupants and the facility operator and staff to determine historical events at the site related to potential contamination sources. Items to discuss include:

- location of any off-lease associated facilities (e.g., remote sumps);
- location of backfilled and/or previously remediated drilling sumps and pits;
- location, characteristics and extent of unproductive land (e.g., salt, sterilant or hydrocarbon damaged soil);
- location of underground storage tanks, pipelines;
- details of past spills and the clean up procedures implemented; and
- details of waste management and waste disposal practices.

4.3 Documentation of Phase 1 Results

Phase 1 ESA results should be recorded on the form contained in Appendix 3. If the Phase 1 assessment confirms that there are no reasons to suspect contamination at the site, the form must be retained in the company's records and made available upon request of Alberta Environment or the landowner. Documentation obtained for the Phase 1 ESA should not be submitted with the application for a reclamation certificate.

When a Phase 1 ESA concludes that contamination is likely present, appropriate action must be taken before the site is reclaimed and an application is submitted for a reclamation certificate.

5.0 Contacts

Information about this guideline can be obtained from any of the following Alberta Environment regional offices:

REGIONAL OFFICES

Bow Region
Calgary Office (403) 297-7602

Northeast Boreal Region
Edmonton Office (780) 427-7617

Northeast Slopes Region
Stony Plain Office (780) 963-6131 Ext. 222

Northwest Boreal Region
Peace River Office (780) 624-6402

Parkland Region
Red Deer Office (403) 340-7052

Prairie Region
Lethbridge Office (403) 381-5322

Appendix 1. Common Contamination Sources at Upstream Oil and Gas Sites

Potential Contamination Sources	
Wellsites	Well head
	Storage tank and area
	Flare pit
	Emergency earthen pit (brine)
	Pits of unknown origin
	Drilling waste sumps / Drilling waste disposal sites
Batteries, compressors, treatment and processing facilities	Flowline/pipeline
	Gas pipeline
	Blow down tank and area
	Metering equipment
	Pig trap (flowline)
	Pig trap (pipeline)
	Treater and separator
	Dehydrator
	Salt water storage tank
	Crude oil storage tank
	Other storage tanks
	Tankfarm area
	Refined product storage
	Ecology pit
	Desand pit
	Flare knock out tank
	Flare line
	Flare pit
	Emergency earthen pit (brine)
	Ponds
	Pits of unknown origin
Spills	Saltwater
	Crude oil
	Emulsion
	Condensate
	Refined products

Appendix 2. Contaminants Commonly Found at Upstream Oil and Gas Sites

Feature	Possible products	Associated Parameters
Wellhead/Injection Wells/Headers	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	workover fluids	pH, salinity, methanol, glycol, biocides
	sterilants	atrazine, bromacil, diuron, linuron, simazine, tebuthiuron
	crude oil	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
Drilling Waste Sumps	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	crude oil	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
	metals	copper, cadmium, chromium, nickel, lead, vanadium, zinc
	chemical additives	pH, sodium, potassium, salinity, chlorides, sulphates
	solvents	halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane
Pig Launcher/Receiver	pigging wax	extractable hydrocarbons (C_{20}+)
	solvents used to clear, de-ice the lines	methanol, halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane
	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	condensate	BTEX compounds, PAHs, extractable hydrocarbons ($C_{11} - C_{60}$), purgeable hydrocarbons
	crude oil	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
Separator	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	crude oil	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
Compressor	lube oil	extractable hydrocarbons (mineral oil and grease), PAHs, metal residues from used lube oil (chromium, lead, zinc, copper)
	metal residues	Tier 1 metals
	mercury from old metering equipment	mercury
Dehydration Units/Line Heaters	glycol	glycol, BTEX compounds, salinity, sodicity, chlorides, sulphates, extractable hydrocarbons
	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation

Feature	Possible Products	Associated Parameters
Tankage	produced water (water storage and free water knockout)	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	crude oil	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
	solvents released during cleaning of tanks	halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane
	tank bottom sludge	extractable hydrocarbons (mineral oil and grease), PAHs, BTEX compounds, Tier 1 metals/inorganics, salinity, sodicity, chlorides sulphates
	chemicals (sweetening agents, caustic, glycol, etc.)	amines, sulfolane, salinity, sodicity, glycols, acidity (pH), nitrogenous compounds
Drums	chemicals: corrosion inhibitors, methanol, degreasers/solvents	methanol, halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane, mercaptan
Flare Pit	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
	crude oil	Extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics
	glycols, amines, pigging wax	ethylene, diethylene glycol, amines, extractable hydrocarbons (C_{30}+)
	condensate	BTEX compounds, extractable hydrocarbons ($C_{11} - C_{30}$+), purgeable hydrocarbons, PAHs
	general waste/domestic waste including tires, glass, cement, filters, metal cable	Tier 1 metals and inorganics
	used anodes/cathodes, frac sand	Tier 1 metals and inorganics, including radioactive materials
	floor drain liquids including solvents, lube oils	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics, halogenated solvents including but not restricted to: dichloromethane, chloroform, dichloroethane, trichloroethane
Buildings	floor drain liquids including solvents, lube oils, detergents	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics, halogenated solvents including but not restricted to: dichloromethane, chloroform, dichloroethane, trichloroethane
	damaged metering equipment	mercury, barium, zinc, lead, chromium, copper, cadmium

Feature	Possible Products	Associated Parameters
Amine Sumps	amines	DEA, MEA, DIPA, nitrogenous residues
	caustic, elemental sulphur, sulphate	S, SO_4^{2-}, salinity, sodicity, soil acidity (pH), soluble metals (Tier 1 metals/inorganics)
	floor drain liquids including solvents, lube oils, detergents	extractable hydrocarbons ($C_{11} - C_{60}$), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics halogenated solvents including but not restricted to: dichloromethane, chloroform, trichloroethane
Sulphur Storage Areas	elemental sulphur	S, SO_4^{2}, soil acidity (pH), solubilized metals (Tier 1 metals/inorganics), salinity
Flare Stack U/G Knockout Tank	condensate	BTEX and purgeable hydrocarbons, extractable hydrocarbons($C_{11} - C_{60}$)
	produced water	salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation
Boneyard / Laydown Area	hydrocarbons	extractable hydrocarbons, PAHs
	chemicals	salinity, sodicity, pH, Tier 1 metals/inorganics, solvents, EOX phenols
Ponds	evaporation pond	salinity, sodicity, chlorides, sulphates, metals, BTEX and TPH, extractable hydrocarbons
	sulphur block runoff pond	acidity (pH), salinity, sulphates, Tier 1 metals/inorganics
	sewage treatment pond	salinity, nitrogenous compounds, coliform bacteria
	amine runoff pond	salinity, sodicity, amines, nitrogenous compounds
Fire Training Area	hydrocarbons	BTEX, purgeable and extractable hydrocarbons, PAHs, Tier 1 metals/inorganics
Landfills	construction debris (concrete, wood, cables, etc.)	salinity, pH, Tier 1 metals/inorganics
	catalyst	salinity, pH, Tier 1 metals/inorganics, leachate metals
	lube oils, sludges	BTEX and purgeable hydrocarbons, extractable hydrocarbons, PAHs, Tier 1 metals/inorganics
	sulphur	pH, salinity, elemental sulphur, sulphates
	chemicals	EOX, phenols, solvents, salinity, sodicity, pH, Tier 1 metals/inorganics
	plant waste (filters, herbicides, etc.)	BTEX and purgeable hydrocarbons, glycols, extractable hydrocarbons, amines, herbicides, sterilants
USTs	floor drain liquids	BTEX and total purgeable and extractable hydrocarbons, PAHs, solvents, Tier 1 metals/inorganics
	fuel	BTEX, purgeable hydrocarbons, extractable hydrocarbons
	flare knockout	BTEX, purgeable and extractable hydrocarbons, salinity, chlorides

Appendix 3. Phase 1 ESA Guideline Form for Upstream Oil and Gas Sites

The operator should use the following form to collect and record information from the Phase I ESA. Alberta Environment will expect to see this form or one that contains the same information if it conducts an audit.

1.0 GENERAL SITE INFORMATION

Facility Name:_____ Surface Location (LSD):_____

License No.:_____ MSL/ROE /LOC, if Public Land:_____

Licensee:_____ Operator:_____

Current Regulatory Status:_____

Well Type: ☐ D&A ☐ Oil ☐ Gas ☐ Disposal ☐ Other _____

Sour: (>1%) ☐ yes ☐ no

Condensate ☐ yes ☐ no

Depth (m):

Pipeline Type: ☐ Oil ☐ Gas ☐ Saltwater ☐ Other _____

2.0 RECORDS REVIEW

2.1 COMPANY FILE REVIEW

Review Date:_____ Reviewed By: _____

2.1.1 Drilling Information Available

Were drilling records reviewed? ☐ Yes ☐ No

Drilling Date:_____

Sump Location (attach diagram if present):_____

Mud Type:_____

Mud/Fluid Disposal Method(s) and Location(s):_____

Other (includes waste storage/handling, etc.):_____

2.1.2 Production Information Available

☐ Yes ☐ No

Historical or current associated infrastructure (includes tankage, pipelines, process skids, and access roads.):

_____

Flare Pits: ☐ Yes ☐ No

Details/Location:_____

Underground Storage Tanks Noted: ☐ Yes ☐ No Capacity: _____

Location: _____

Aboveground Storage Tanks Noted: ☐ Yes ☐ No Capacity: _____

Location:_____

Herbicide Use: ☐ Yes ☐ No

Details:_____

Other (includes waste storage/handling/chemical storage, buried pits and landfills, etc.):

_____

_____

2.1.3 Pipeline Information

From:_____ To:_____

Diameter:_____ Depth:_____Abandoned: In-Place (Y/N)_____Removed (Y/N)_____

2.1.4 Environmental Information Available

☐ Yes ☐ No

Spills Releases: ☐ Yes ☐ No (if yes, attach a brief description including spill material and volume)

Location/Extent:_____

Type (EUB codes):_____ Volume Recovered:_____

Remediation Action (when initiated, target completion date, attach assessment and remediation details if available):

_____

_____

Reported to Regulatory Agency: ☐ Yes ☐ No

If Yes, Identify Regulatory Agency:_____

2.1.5 Land Information

Landowner/Occupant Complaints: ☐ Yes ☐ No

Identify Issue(s) of Concern:_____

2.1.6 Former Third Party ESA(s) Information Available

☐ Yes ☐ No

If Yes, Consultant:_____Report Title:_____ Report Date:_____

Details:_____

2.2 HISTORICAL AERIAL PHOTOGRAPH REVIEW

Review Date:_____ Reviewed By:_____

Photo ID:_____ Year:_____ Scale:_____

Evidence of Former Infrastructure or Areas of Potential Contamination:_____

_____

Photo ID:_____ Year:_____ Scale:_____

Evidence of Former Infrastructure or Areas of Potential Contamination:_____

_____

Photo ID:_____ Year:_____ Scale:_____

Evidence of Former Infrastructure or Areas of Potential Contamination:_____

_____

3.0 INTERVIEWS (e.g., Present and Past Operators and Landowners)

General Field Interview Held: ☐ Yes ☐ No

Information Pertinent to this Site: ☐ Yes ☐ No

If Yes, Interview Date:_____ Interviewed By:_____

Person Interviewed and Position:_____

Details: *(request information on former facilities, presence and details of spills, pits, waste storage/handling, vegetation control, etc.).*_____

_____

4.0 SITE VISIT

Date (m/d/y):_____ Assessor:_____

Equipment or Tankage Present (or visual signs of former facilities): ☐ Yes ☐ No

Details:_____

Visual Signs of Open or Potentially Buried Earthen Pits: ☐ Yes ☐ No

Details:_____

Evidence of Past Spills (includes cumulative releases and well centre impacts): ☒ Yes ☐ No

Details:_____

Adjacent land affected by operations on the site? ☐ Yes ☐ No

Vegetation Stress Apparent: ☐ Yes ☐ No

Details:_____

Specific File or Air Photo Review Information Validated in Field: ☐ Yes ☐ No

Photographs:

Photo 1 (*photo description*):_____

Photo 2 (*photo description*):_____

(add additional photographs if necessary)

Site Characteristics

Surrounding land use: N:_____ S:_____ E:_____ W:_____

Topography:_____

Vegetation:_____

Proximity to residence, water well, surface waterbody (e.g., pond, stream, river):_____

5.0 CONCLUSIONS AND RECOMMENDATIONS

Is sufficient information available to conclude the likelihood that contamination is present? ☐ Yes ☐ No

If yes, is the contamination likely a result of the operation? ☐ Yes ☐ No

If contamination is present, is there sufficient information available to comment on the extent of contamination?

☐ Yes ☐ No

6.0 DECLARATION

I_____ of _____ certify that, to the best of my knowledge, all of the aforementioned information is accurate. This Phase I Environmental Site Assessment (ESA) was conducted for _____, for the above noted location. All the pertinent information gathered during the Phase I ESA has been provided within this report.

Date:_____

7.0 ATTACHMENTS

⇒ Photos (from Section 2.2)

⇒ Lease Survey Plan (with field notations)